

Listing of Claims

This listing replaces all prior versions and listings of claims in the application:

Claims **1-25.** (canceled)

26. (new) A plasma processing system comprising:

a processing tool having a process chamber;

means coupled to the process chamber for providing in the process chamber at least two signals in a frequency range effective to couple energy to and from a plasma in the process chamber, depending on the parameters of the system, the signals including a first signal at a first frequency and a second signal at a second frequency selected to produce an inter-modulation product at a third frequency in said frequency range that is neither equal to nor a multiple of the first frequency or the second frequency;

means for detecting the inter-modulation product from energy coupled from a plasma in the chamber; and

means coupled to the filter/detector and programmed for producing an output signal indicating the presence of a plasma in the chamber in response to the detection of the inter-modulation product and indicating the absence of a plasma from the chamber in response to an absence of the detection of the inter-modulation product.

27. (new) The plasma processing system of claim **26** further comprising:

means for controlling the operation of the processing tool in response to the output signal.

28. (new) The plasma processing system of claim **26** further comprising:

means for controlling the operation of the processing tool in response to the output signal to perform a plasma process in the chamber when indicating the presence of the plasma and to suspend processing when indicating the absence of a plasma.

29. (new) The plasma processing system of claim **26** wherein the inter-modulation product includes an odd-order product of the first RF signal and the second RF signal.

30. (new) The plasma processing system of claim **26** wherein the inter-modulation product includes a fifth-order product of the first RF signal and the second RF signal.

31. (new) The plasma processing system of claim **26** wherein the inter-modulation product includes a seventh-order product of the first RF signal and the second RF signal.

32. (new) A plasma processing system comprising:

- a processing tool having a vacuum process chamber;

- at least one RF energy source coupled to the process chamber and operable to provide in the process chamber a first RF signal at a first frequency and a second RF signal at a second frequency, both signals being in a frequency range effective to couple energy to and from a plasma in the process chamber, depending on the parameters of the system, the first and second frequencies being selected to produce, if multiplied together, an inter-modulation product at a frequency in said frequency range that is neither equal to nor a multiple of the first frequency or the second frequency;

- a band-pass filter/detector operable to detect the inter-modulation product from energy coupled from a plasma in the chamber; and

- a controller coupled to the filter/detector and programmed to produce an output indicating the presence of a plasma in the chamber in response to the detection of the inter-modulation product and indicating the absence of a plasma from the chamber in response to an absence of the detection of the inter-modulation product.

33. (new) The plasma processing system of claim **32** wherein:

the at least one RF energy source includes a plasma-sustaining source of RF energy coupled to the chamber to sustain a plasma in the chamber; and
the RF energy includes one of the first and second signals.

34. (new) The plasma processing system of claim **32** further comprising:

a substrate support in the chamber;
the at least one RF energy source including a bias potential source of RF energy coupled to the substrate support to bias a substrate on the support; and
the RF energy includes one of the first and second signals.

35. (new) The plasma processing system of claim **32** further comprising:

a target in the chamber;
the at least one RF energy source including a source of RF energy coupled to the target to sputter the target; and
the RF energy includes one of the first and second signals.

36. (new) The plasma processing system of claim **32** wherein:

one or both of the first and second signals includes RF energy coupled to the chamber for purposes other than energizing a plasma, biasing a substrate or sputtering a target and for serving as a test signal.

37. (new) The plasma processing system of claim **32** further comprising:

a substrate support in the chamber;
a target in the chamber;
one of the first and second signals including RF energy from the at least one RF energy source that includes either:

a plasma-sustaining source of RF energy coupled to the chamber to sustain a plasma in the chamber;

a bias potential source of RF energy coupled to the substrate support to bias a substrate on the support; or

a sputtering energy source of RF energy coupled to the target to sputter the target; and

the other one of the first and second signals including RF energy from a different one of the at least one RF energy source that includes either:

a plasma-sustaining source of RF energy coupled to the chamber to sustain a plasma in the chamber;

a bias potential source of RF energy coupled to the substrate support to bias a substrate on the support;

a sputtering energy source of RF energy coupled to the target to sputter the target; or

a test source of RF energy coupled to the chamber for purposes other than energizing a plasma, biasing a substrate or sputtering a target and for serving as a test signal.

38. (new) The plasma processing system of claim **32** further comprising:

an antenna coupled to the detector that relies on a substrate support, a plasma electrode or an RF coupling component in the process chamber.

39. (new) The plasma processing system of claim **32** further comprising:

an antenna coupled to the detector that is distinct from a substrate support, a plasma electrode or other RF coupling component in the process chamber.

- 40. (new)** The plasma processing system of claim **32** further comprising:
control logic in the controller responsive to the filter/detector; and
one or more monitoring devices controlled by the control logic so that performance of a process in the chamber can be conditioned on the presence of a plasma in the chamber.
- 41. (new)** The plasma processing system of claim **32** further comprising:
process control logic in the controller responsive to the filter/detector and operable to condition performance of a process in the chamber on the presence of a plasma in the chamber.
- 42. (new)** The plasma processing system of claim **32** wherein:
the power source comprises at least one of an RF-to-DC converter configured to convert energy emitted from a process related signal into a DC signal, an RF-to-DC converter configured to convert a non-process related signal into a DC signal, a DC-to-DC converter, and a battery.
- 43. (new)** The plasma processing system of claim **32** wherein:
the controller comprises at least one of a microprocessor, a microcontroller, a timer, digital signal processor (DSP), memory, receiver, A/D converter, and D/A converter
- 44. (new)** The plasma processing system of claim **32** wherein:
the at least one RF source includes a sine wave oscillator.

- 45. (new)** A control system for determining the presence or absence of a plasma in a plasma processing chamber within a semiconductor processing system comprising:
- means for coupling at least two RF signals into a processing space; and
 - means for coupling, from the processing space, the input of a detector configured to detect plasma-produced inter-modulation products of the at least two signals.
- 46. (new)** The control system of claim **45**, wherein the inter-modulation products include at least one odd order inter-modulation product of the at least two signals.
- 47. (new)** The control system of claim **45**, wherein the at least two RF signals are from 10 MHz to 1500 MHz.